

## PATENT SPECIFICATION

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(Under Section 6 (1) (a) of the Patents &c. (Emergency) Act, 1939,  
the proviso to Section 91 (4) of the Patents and Designs Acts,  
1907 to 1942 became operative on Aug. 13, 1945.)

## COMPLETE SPECIFICATION

## Improvements in the Protective Control of the Operations of Machine Tools

We, SOCIETE ANONYME ANDRE CITROEN, a Body Corporate, duly organised according to the French Laws, of 117—167, Quai de Javel, Paris, (Seine Department), France, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

- 10 It is well known that every metal electrode, such as a plate, a wire or the like, in which a high-frequency wave takes place, is surrounded by an electromagnetic field the shape of which depends on that of the electrode. A foreign body which may be of wood or metal, or the operator's hand, when moved into the field of such an electrode, will alter the electrode-mass capacity and modify the tuning conditions of the oscillatory system. The said change in the capacity depends on the shape of the electrode, on that of the foreign body, and on the character of said body.
- 25 Thus, the operator's hand will produce a definite variation in the electrode-mass capacity. A piece of wood, when brought near to the same electrode under the same conditions, will produce a different variation in the said capacity. In other words, the electrode will act as a detector with respect to every object that comes into its field, and will discriminate between the hand and the piece of wood when one or the other is held up to it.

The present invention is based on the application to machine tools of the phenomena briefly outlined above.

- 40 This application consists in arranging, in proximity to the tool of the machine, an electrode insulated from the mass of the machine and connected to a high-frequency amplifier. The electrode may be constituted by the tool itself.

- 45 The field radiated by this electrode in a predetermined zone undergoes a variation in the event of foreign bodies being introduced, and this variation is expressed by stoppage of the machine, with the addition, if desired, of a visible or audible signal, or the actuation of an accessory appliance of any kind.

Since the electrode-mass capacity is

very great, the electric circuit is so regu-

lated that a very slight variation —  $\frac{dC}{C}$  — effects

the stoppage of the machine tool, or produces some other electrical or electro-mechanical effect.

The said applications concern all kinds of machine tools, irrespective of the cutting tool used, or the shape of the parts operated upon, and of the metal or material shaped, whether it be wood, rubber, fibre or the like.

According to a particular feature of this invention, in order to provide reliably for the efficiency of the said applications, particularly as far as safety is concerned, any failure of the high-frequency amplifier results in the lighting of a visual signal, such as a pilot-light, or in the stopping of motor driving the machine tool.

Two embodiments of the invention, employing a variation in capacity for the safety of the man in charge of a rubber-shearing machine in the first instance and of a moulding-spindle machine in the second instance, are considered by way of example but not of limitation in the following description and are illustrated in the accompanying drawings, in which:—

Figure 1 is a diagrammatic vertical cross-sectional view of the said rubber-shearing machine, and

Figures 2 and 3 show the moulding-spindle machine equipped according to this invention in perspective, partly broken away, and in plan respectively.

The rubber-shearing machine primarily comprises a knife 1 descending through a slot 2 in a table 3, and adapted to shear a rubber sheet 4, which travels below the knife in the direction shown by the arrow 5.

According to this invention, safety in the operation of the shearing machine is provided for by the following arrangements:—

An electrode 6 consisting of a copper strip is located in front of the knife 1 and is of the same length. This electrode, which is insulated from the shearing machine mass and connected through a

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shielded cable with a high-frequency amplifier, not shown, radiates a field 7, emanating from its lower face and directed towards the table 3; the field 6 is suppressed by a metal shield 8, which is conductively connected with the mass.

Such a sensitiveness is given to the electrode in the adjustment of the amplifier that the rubber sheets to be sheared can pass below the knife without any marked alteration in the electrode-mass capacity. If however the operator inadvertently passes his hand below the electrode, a more considerable variation will thus be set up in the capacity, whereby the machine braking gear will immediately be influenced through the medium of the amplifier and of a series of relays. The knife then is stopped in its downward stroke before the hand comes into contact with it.

Where the character of the work performed in the machine demands the attendance of two operators, one at either side of the knife, an additional electrode 9 and a shield 10 similar to the preceding electrode 6 and shield 8 are associated with the system and will protect the back face of the knife.

Providing for safety in the operation of the machine by the arrangement described will not interfere in the least with the useful movements of the operator.

The moulding-spindle machine shown in Figs. 2 and 3 comprises a table 11 formed with a circular aperture through which the machine spindle 12 projects. This spindle carries the cutter or cutting tool 13. Arranged on the table is a guide 14, which has a pair of bevelled wooden members 15 immovably secured thereto, against which the wood to be shaped is pressed and pushed by the operator.

Safety in the operation of the machine is provided for by the following arrangements:—

Each wooden part 15 carries an electrode 16, consisting of a copper plate which is of the same height as the guide, and is conductively connected through a shielded cable with the high-frequency amplifier. Each electrode 16 radiates a field 17, which is influenced by the presence of earthed metal shields 18 set in the wooden members 15. The two fields meet each other in an area located outside the circular path of the cutter, and provide an electro-magnetic shield in front thereof.

The amplifier is so adjusted that wood-pieces of definite dimensions can be passed through the field pair on the machine without causing any substantial variation in the electrode-mass capacity. Should it happen however that the hand by which the wood-piece is guided and accompanied in its shaping travel penetrates into the protective screen formed in front of the cutter by the fields of the electrodes 16, the variation in the electrode-mass capacity set up by the said hand will then influence the amplifier and a series of relays.

The last of these relays closes the circuit of an electro-magnet 19, arranged underneath the table 11. This electro-magnet releases a spring 20, which is also arranged under the table, and which is attached to the guide 14, to which it imparts a rotation of about 20 degrees around the spindle 21. This displacement of the guide immediately pushes the operator's hand, as well as the work-piece, out of the danger zone.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A method of or means for controlling the operation of machine tools for the protection of the operator, consisting in providing, in proximity to the tool, an electrode insulated from the mass of the machine and connected to a high-frequency amplifier.

2. A method of or means for controlling the operation of machine tools as claimed in Claim 1, characterised by the feature that the electrode is constituted by the tool itself, which is insulated by a screen connected to the mass of the machine.

3. A method of or means for controlling the operation of machine tools as claimed in Claim 1 or 2, characterised by the feature that the electric circuit is regulated to come fully into action for such a variation of the electrode-mass capacity as that created by a workman's hand being introduced into the magnetic field.

4. A method of or means for controlling the operation of machine tools for the protection of the operator, substantially as hereinbefore described with reference to the accompanying drawings.

Dated this 13th day of August, 1945.

MARKS & CLERK.

*[This Drawing is a reproduction of the Original on a reduced scale.]*

